इंटरनेट मानक

Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”
Mazdoor Kisan Shakti Sangathan
“The Right to Information, The Right to Live”

“पुराने को छोड नये के तरफ”
Jawaharlal Nehru
“Step Out From the Old to the New”

IS 15545-1 (2004): Rorary shaft lip type seals incorporating thermoplastic sealing elements, Part 1: Nominal dimensions and tolerances [MED 30: Gaskets and Packing]

“ज्ञान से एक नये भारत का निर्माण”
Satyanarayan Gangaram Pitroda
“Invent a New India Using Knowledge”

Act Number 22 of 2005
The Indian Parliament
RIGHT TO INFORMATION

Made Available By
Public.Resource.Org

“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”
Bhartṛhari—Nītiśatakam
“Knowledge is such a treasure which cannot be stolen”

BLANK PAGE

BRUTUM FULMEN

IGNORANTIA JURIS NON EXCUSAT

PROTECTED BY COPYRIGHT

IS 15545 (Part 1) : 2004
ISO 16589-1 : 2001

भारतीय मानक

तापसुघट्य सीलिंग एलीमेंट युक्त रोटरी शॉफ्ट लिप-टाइप सील

भाग 1 अभिहित आयाम और छूट

Indian Standard

ROTARY SHAFT LIP-TYPE SEALS INCORPORATING THERMOPLASTIC SEALING ELEMENTS

PART 1 NOMINAL DIMENSIONS AND TOLERANCES

ICS 23.100.60; 83.140.50

© BIS 2004

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

December 2004 **Price Group 6**

Basic Fluid Power Sectional Committee, MGP 14

NATIONAL FOREWORD

This Indian Standard (Part 1) which is identical with ISO 16589-1 : 2001 'Rotary shaft lip-type seals incorporating thermoplastic sealing elements — Part 1: Nominal dimensions and tolerances' issued by the International Organization for Standardization (ISO) was adopted by the Bureau of Indian Standards on the recommendations of the Basic Fluid Power Sectional Committee and approval of the Medical Instruments, General and Production Engineering Division Council.

Rotary shaft lip-type seals are used to retain fluid in equipment where the differential pressure is relatively low. Typically, the shaft rotates and the housing is stationary, although in some applications the shaft is stationary and the housing rotates.

Dynamic sealing is normally the result of a designed interference fit between the shaft and a flexible element incorporated in the seal.

Similarly, a designed interference fit between the outside diameter of the seal and the diameter of the housing bore retains the seal and prevents static leakage.

Careful storage, handling and proper installation of all seals are necessary to avoid hazards, both prior to and during installation, which would adversely affect service life.

The text of the ISO Standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

b) Comma (,) has been used as a decimal marker in the International Standard while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

CROSS REFERENCES

In this adopted standard reference appears to certain International Standards for which Indian Standards also exist. The corresponding Indian Standards which are to be substituted in their places are listed below along with their degree of equivalence for the editions indicated:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
ISO 286-2 : 1988 ISO system of limits and fits — Part 2 : Tables of standard tolerance grades and limit deviations for holes and shafts	IS 919 (Part 2) : 1993 ISO system of limits and fits: Part 2 Tables of standard tolerance grades and limit deviations for holes and shafts (*first revision*)	Identical
ISO 5598 : 1985 Fluid power systems and components — Vocabulary	IS 10416 : 1992 Fluid power systems and components — Vocabulary (*first revision*)	do
ISO 16589-2 : 2001 Rotary shaft lip-type seals incorporating thermoplastic sealing elements — Part 2 : Vocabulary	IS 15545 (Part 2) : 2004 Rotary shaft lip-type seals incorporating thermoplastic sealing elements: Part 2 Vocabulary	do

(*Continued on third cover*)

CONTENTS

Page

1 Scope 1

2 Normative references 1

3 Terms and definitions 1

4 Seal types and examples 2

4.1 Seal outside diameter construction 2

4.2 Sealing lip arrangements 2

5 Letter symbols 3

6 Nominal dimensions 3

7 Shafts 4

7.1 Shaft ends 4

7.2 Diametral tolerance 5

7.3 Surface roughness and hardness 5

8 Housings 6

8.1 General 6

8.2 Dimensions 6

8.3 Housing bore tolerance 7

8.4 Housing bore surface roughness 7

9 Seal tolerances 7

10 Size identification code 8

11 Identification statement (Reference to this part of ISO 16589) 9

Annex A (informative) — Seal specification 10

Indian Standard

ROTARY SHAFT LIP-TYPE SEALS INCORPORATING THERMOPLASTIC SEALING ELEMENTS

PART 1 NOMINAL DIMENSIONS AND TOLERANCES

1 Scope

ISO 16589 describes seals utilizing sealing elements manufactured from suitably formulated compounds, based on thermoplastic materials, such as polytetrafluoroethylene (PTFE).

NOTE ISO 16589 is complementary to ISO 6194 which covers elastomeric seals.

This part of ISO 16589 specifies the nominal dimensions and tolerances of the seals, shafts and housings, as well as a dimensional identification code.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 16589. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 16589 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 286-2:1988, *ISO system of limits and fits — Part 2: Tables of standard tolerance grades and limit deviations for holes and shafts*

ISO 4287:1997, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Terms, definitions and surface texture parameters*

ISO 4288:1996, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Rules and procedures for the assessment of surface texture*

ISO 5598:1985, *Fluid power systems and components — Vocabulary*

ISO 16589-2:2001, *Rotary shaft lip-type seals incorporating thermoplastic sealing elements — Part 2: Vocabulary*

3 Terms and definitions

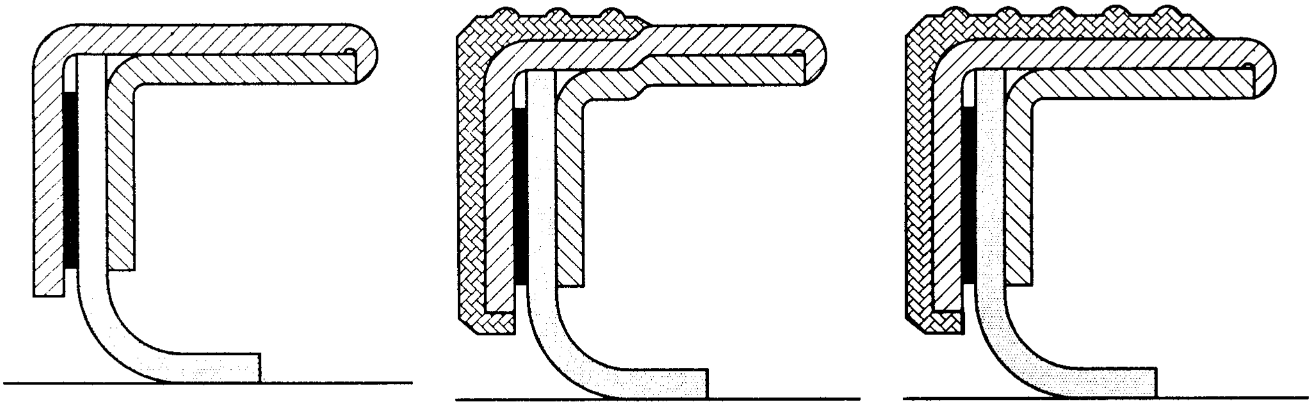
For the purposes of this part of ISO 16589, the terms and definitions given in ISO 5598 and ISO 16589-2 apply.

4 Seal types and examples

4.1 Seal outside diameter construction

The constructions shown in Figure 1 show three basic types.

NOTE Because of some variations in design details, or seals made by different manufacturers, the constructions shown are intended only as representative of the basic types.



Type 1

Metal-cased

Type 2

Semi-rubber-covered metal-cased

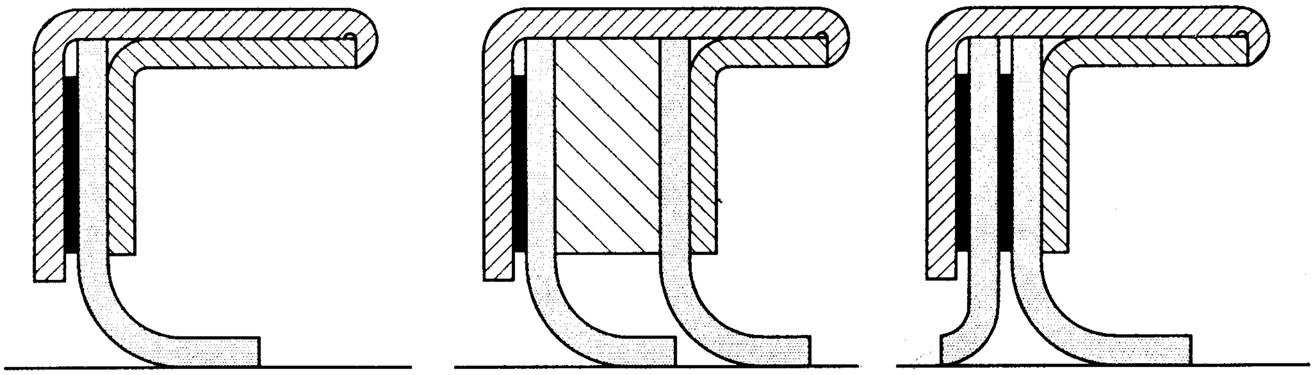
Type 3

Rubber-covered metal-cased

Figure 1 — Three basic types of outside diameter construction

4.2 Sealing lip arrangements

Some examples of sealing lip arrangements are shown in Figure 2.



Example 1

Single lip

Example 2

Double lip in tandem

Example 3

Single lip with thermoplastic minor lip

Figure 2 — Sealing lip arrangements

The sealing lip arrangements shown in Figure 2 can be used with each seal outside diameter construction shown in Figure 1.

Hydrodynamic aids are incorporated by some manufacturers in certain applications.

The design of the sealing lip should be agreed on between manufacturer and purchaser.

5 Letter symbols

Letter symbols used in this part of ISO 16589 are as follows:

b is the nominal width of the seal and is associated with the housing bore depth (see Figure 3);

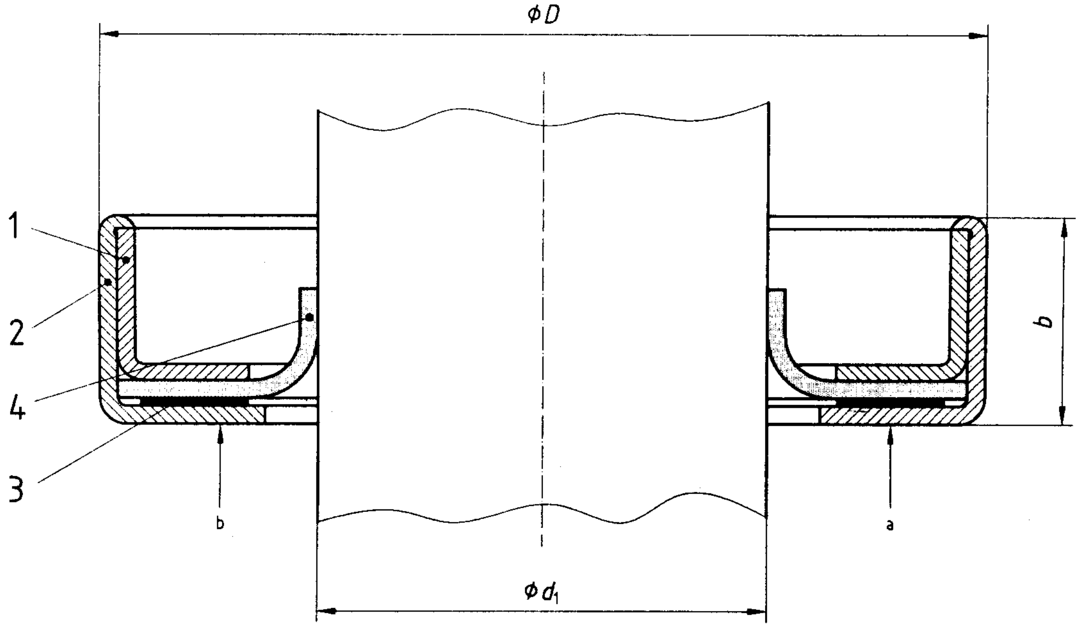
d_1 is the nominal diameter of the shaft to be used with the seal (see Figure 4);

d_2 is the minor diameter at the shaft lead-in chamfer (see Figure 4);

D is the nominal diameter of the housing bore and of the outer diameter of the seal (see Figures 3 and 5).

6 Nominal dimensions

The nominal dimensions of the seals are shown in Figure 3 and given in Table 1:



Key

1 Inner case
2 Outer case
3 Gasket (if incorporated)
4 Sealing element

a Rotation viewed from back face
b Identification (preferred location) on back side

Figure 3 — Seal

Table 1 — Nominal dimensions

Dimensions in millimetres

d_1	D	b[a]	d_1	D	b[a]	d_1	D	b[a]	d_1	D	b[a]
6	16	7	25	52	7	45	65	8	120	150	12
6	22	7	28	40	7	50	65	8	130	160	12
7	22	7	28	47	7	50	72	8	140	170	15
8	22	7	28	52	7	55	72	8	150	180	15
8	24	7	30	42	7	55	80	8	160	190	15
9	22	7	30	47	7	60	80	8	170	200	15
10	22	7	30	52	7	60	85	8	180	210	15
10	25	7	32	45	8	65	85	10	190	220	15
12	24	7	32	47	8	65	90	10	200	230	15
12	25	7	32	52	8	70	90	10	220	250	15
12	30	7	35	50	8	70	95	10	240	270	20
15	26	7	35	52	8	75	95	10	260	300	20
15	30	7	35	55	8	75	100	10	280	320	20
15	35	7	38	55	8	80	100	10	300	340	20
16	30	7	38	58	8	80	110	10	320	360	20
18	30	7	38	62	8	85	110	12	340	380	20
18	35	7	40	55	8	85	120	12	360	400	20
20	35	7	40	62	8	90	120	12	380	420	20
20	40	7	42	55	8	95	120	12	400	440	20
22	35	7	42	62	8	100	125	12	450	500	25
22	40	7	45	62	8	110	140	12	480	530	25
22	47	7									
25	40	7									
25	47	7									

[a] The width b may be increased to permit the use of more complex seal configurations.

7 Shafts

7.1 Shaft ends

The end of the shaft shall be provided with a lead-in chamfer as shown in Figure 4 and given in Table 2, and shall be free from burrs, sharp corners or rough machining marks.

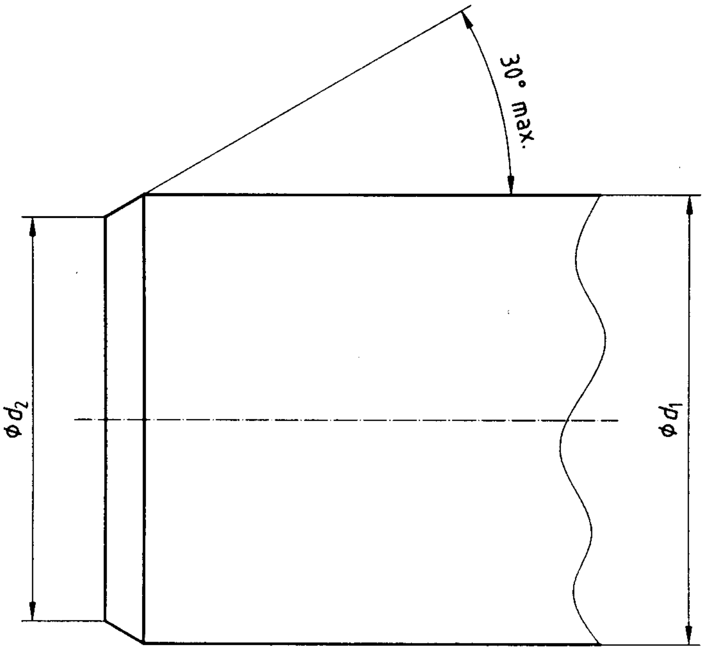


Figure 4 — Shaft lead-in chamfer

Table 2 — Shaft lead-in chamfer

Dimensions in millimetres

Shaft diameter d_1	$d_1 - d_2$[a] min.	**Shaft diameter** d_1	$d_1 - d_2$[a] min.
$d_1 \leqslant 10$	1,5	$50 < d_1 \leqslant 70$	4
$10 < d_1 \leqslant 20$	2	$70 < d_1 \leqslant 95$	4,5
$20 < d_1 \leqslant 30$	2,5	$95 < d_1 \leqslant 130$	5,5
$30 < d_1 \leqslant 40$	3	$130 < d_1 \leqslant 240$	7
$40 < d_1 \leqslant 50$	3,5	$240 < d_1 \leqslant 480$	11

[a] If a shaft lead-in chamfer radius is used, it shall be no less than this diametral difference.

NOTE Assembly tools are specified in ISO 16589-3 and should be used to ensure that the sealing lip/elements are not damaged.

7.2 Diametral tolerance

The shaft shall have a diametral tolerance not greater than h11 (see ISO 286-2).

7.3 Surface roughness and hardness

7.3.1 Surface roughness

The seal contact surface of a ground shaft shall be finished to a surface roughness of between Ra 0,2 µm and Ra 0,63 µm, or between Rz 0,8 µm and Rz 2,5 µm, measured in the axial direction in accordance with ISO 4287 and ISO 4288.

NOTE Shafts which have a very hard coating may require a smoother surface finish; the user should consult the seal manufacturer.

The seal contact surface shall normally be free of machining leads.

7.3.2 Surface hardness

The surface hardness shall be agreed on between purchaser and manufacturer.

8 Housings

8.1 General

The housing contains the bore into which the seal shall be fitted.

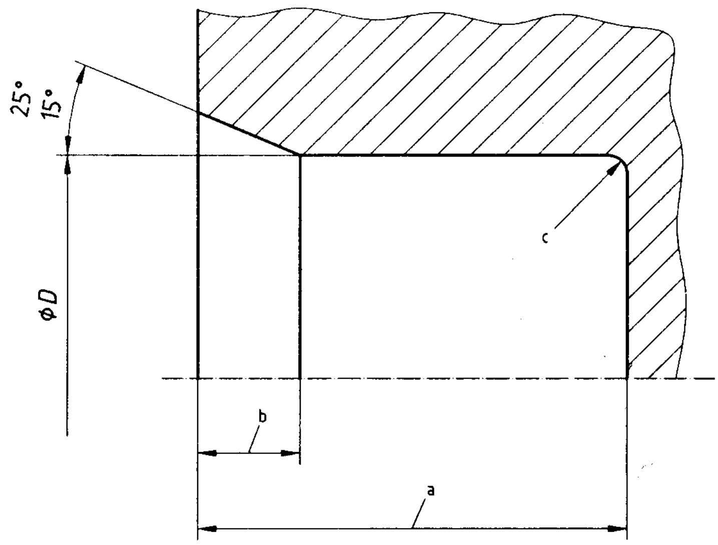
8.2 Dimensions

8.2.1 Where this housing is a rigid, fully machined ferrous part, the housing bore shall be in accordance with 8.3 and 8.4.

8.2.2 The housing bore shall be provided with a lead-in chamfer, free from burrs, as shown in Figure 5 and specified in Table 3.

8.2.3 The housing bore depth and corner radius shall be as shown in Figure 5 and specified in Table 3.

NOTE If the housing is not in accordance with 8.2.1 to 8.2.3 (e.g. non-ferrous or non-metallic material, pressing of ferrous or non-ferrous material), the dimensions, tolerances and lead-in configuration should be agreed between the purchaser and manufacturer.



a Bore depth

b Chamfer length

c Corner radius

Figure 5 — Housing bore

Table 3 — Housing bore dimensions

Dimensions in millimetres

Nominal width b	Minimum housing bore depth	Chamfer length	Maximum housing bore corner radius
$b \leqslant 10$	$b + 1{,}2$	0,7 to 1	0,5
$b > 10$	$b + 1{,}5$	1 to 1,3	0,75

8.3 Housing bore tolerance

The housing bore shall have a diamentral tolerance not greater than H8 (see ISO 286-2).

8.4 Housing bore surface roughness

The surface roughness of the housing bore shall be within Ra 1,6 µm and Ra 3,2 µm, or between Rz 6,3 µm and Rz 12,5 µm, measured in the axial direction in accordance with ISO 4287 and ISO 4288.

9 Seal tolerances

9.1 The recommended seal width tolerances are given in Table 4.

Table 4 — Seal width tolerances

Dimensions in millimetres

Seal width b	Tolerance
$b \leqslant 10$	± 0,3
$10 < b \leqslant 14$	± 0,4
$14 < b \leqslant 18$	± 0,5
$18 < b \leqslant 25$	± 0,6

9.2 To provide an interference fit between the seal outside surface and the housing bore surface, th recommended tolerances for the outside diameter of the seal shall be as given in Table 5.

NOTE Since the interference between the seal outside surface and the housing bore surface is a characteristic related t the design of the seal, it may be necessary for agreement to be reached between purchaser and manufacturer on the limits t be used. See annex A for the recommended form.

Table 5 — Seal outside diameter tolerances

Dimensions in millimetres

Nominal outside diameter D	Diametral tolerance		Roundness tolerance [a]	
	Metal-cased	Rubber-covered [b, c]	Metal-cased	Rubber-covered
$D \leqslant 50$	+ 0,20 + 0,08	+ 0,30 + 0,15	0,18	0,25
$50 < D \leqslant 80$	+ 0,23 + 0,09	+ 0,35 + 0,20	0,25	0,35
$80 < D \leqslant 120$	+ 0,25 + 0,10	+ 0,35 + 0,20	0,3	0,5
$120 < D \leqslant 180$	+ 0,28 + 0,12	+ 0,45 + 0,25	0,4	0,65
$180 < D \leqslant 300$	+ 0,35 + 0,15	+ 0,45 + 0,25	0,25 % of outside diameter	0,8
$300 < D \leqslant 530$	+ 0,45 + 0,20	+ 0,55 + 0,30	0,25 % of outside diameter	1

[a] The roundness tolerance is equal to the difference between the maximum diameter and the minimum diameter derived from three or more equally spaced measurements.

[b] Rubber-covered and semi-rubber-covered seals having a wave profile outside surface are acceptable but will require different tolerances to be agreed on between manufacturer and purchaser.

[c] Rubber-covered and semi-rubber-covered seals employing certain materials other than nitrile may require different tolerances to be agreed on between manufacturer and purchaser.

10 Size identification code

10.1 The size identification code shall consist of the nominal dimensions of the shaft and housing, as given in Table 1.

10.2 Examples of size identification code are given in Table 6.

Table 6 — Size identification code

Dimensions in millimetres

d_1	D	**Size code**
6	16	006016
70	90	070090
400	440	400440

11 Identification statement (Reference to this part of ISO 16589)

Manufacturers are strongly recommended to use the following statement in test reports, catalogues and sales literature when electing to comply with this part of ISO 16589:

"The nominal dimensions and tolerances of the seals, shafts and housings are in accordance with ISO 16589-1:2001, *Rotary shaft lip-type seals incorporating thermoplastic sealing elements — Part 1: Nominal dimensions and tolerances.*"

Annex A
(informative)

Seal specification

A.1 For the convenience of both the purchaser and the manufacturer, it is recommended that the purchaser complete a form such as the one given in Table A.1, to supply the necessary information to the manufacturer to ensure the supply of a seal suitable for the application.

A.2 It is also recommended that the manufacturer complete a form such as the one given in Table A.2 to supply the purchaser with the necessary information to ensure that the seal is in accordance with the equipment design and application requirements, to enable the purchaser to carry out inspection or quality control on the seals supplied by the manufacturer.

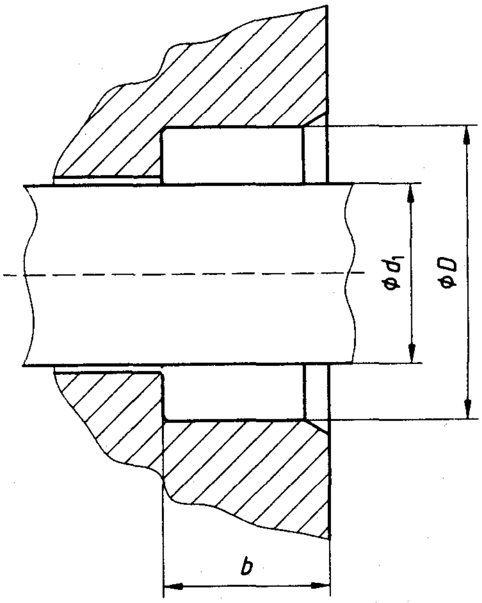
Table A.1 — Purchaser information

Purchaser: Reference:

Application: Assembly drawing:

1 Shaft informaton

a) Diameter (d_1) ....mm max. ....mm min.
b) Material ....
c) Surface roughness *Ra* .... µm *Rz*....................................µm
d) Type of finish ....
e) Hardness ....
f) Chamfer information ....
g) Rotation
  1) Direction of rotation*
    — Clockwise ....
    — Anti-clockwise...
    — Bi-rotational ....
  2) Rotation speed .... r/min
  3) Rotation cycles (Time on ....
      Time off......................................)
h) Other shaft motion (if applicable)
  1) Axial reciprocation
    — Length of stroke..................................... mm
    — Cycles per minute......................................
    — Reciprocation cycles (Time on.....................
      Time off ....)
  2) Circumferentical oscillation
    — Magnitude of oscillation (degrees)..............
    — Cycles per minute...
    — Oscillation cycles (Time on..........................
      Time off...........................)
j) Additional information (i.e. splines, holes, keyways, shaft lead, etc.)



....

2 Housing information

a) Bore diameter (D).............................. mm max. .... mm min.
b) Bore depth (b).................................... mm max. .... mm min.
c) Material...
d) Surface roughness *Ra*.................................. µm *Rz*............................. µm
e) Chamfer information ....
f) Housing rotation (if applicable)
  1) Direction of rotation*
    — Clockwise ....
    — Anti-clockwise...
    — Bi-rotational ....
  2) Rotation speed .... r/min

3 Contained fluid information

a) Type of fluid .... Grades...
b) Fluid temperature Normal... °C Max................................°C Min. ....°C
c) Temperature cycles ....
d) Fluid level ....
e) Fluid pressure.. kPa . ...bar
f) Pressure cycle...

4 Alignment

a) Housing bore eccentricity .... mm
b) Shaft runout (FIM).. mm

5 External conditions

a) External pressure... kPa . ...bar
b) Materials to be excluded (i.e. dust, mud, water, etc.)..
....

---

* Direction of rotation viewed from the backside (region adjacent to the seal which is not in contact with the fluid, e.g. air side).

Table A.2 — Manufacturer information

Manufacturer:	Part No. ....
	Issue No. .... Date ....
Seal specification:	
Type:	Nominal shaft diameter (d_1): ....
Outside diameter (D): .... mm max.	....mm min.
Seal width (b): .... mm max.	....mm min.
Inner case diameter (A): .... mm max.	....mm min.
Sealing lip description (delete where not applicable):	
plain	hydrodynamically aided
uni-rotational	bi-rotational
Sealing lip material	
Case specification:	
Outer case material	Inner case material ....
Outer case thickness	Inner case thickness ....
Gasket material (if incorporated)	
Rubber OD cover material (if incorporated)	
Spring material (if incorporated)	
Optional information	
Test specification:	
....	
Example drawing:	

Key

1 Inner case

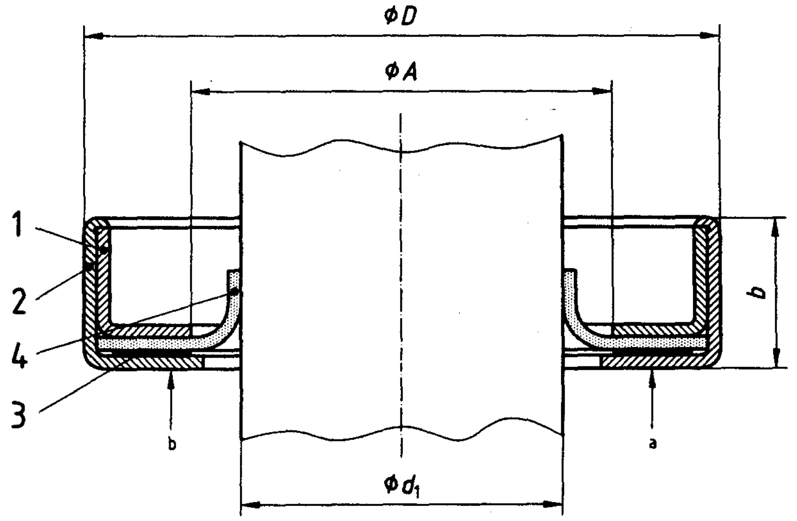
2 Outer case

3 Gasket (if incorporated)

4 Sealing element

[a] Rotation viewed from back face.

[b] Identification (preferred location) on back side.



(*Continued from second cover*)

The Technical Committee responsible for the preparation of this standard has reviewed the provisions of the following ISO Standards and has decided that it is acceptable for use in conjunction with the Standard:

ISO 4287 : 1997	Geometrical Product Specifications (GPS) — Surface texture: Profile method — Terms, definitions and surface texture parameters
ISO 4288 : 1996	Geometrical Product Specifications (GPS) — Surface texture: Profile method — Rules and procedures for the assessment of surface texture

Under the general title, Rotary shaft lip-type seals incorporating thermoplastic sealing elements, there are five parts as per following:

IS 15545 (Part 1) : 2004 Nominal dimensions and tolerances

IS 15545 (Part 2) : 2004 Vocabulary

IS 15545 (Part 3) : 2004 Storage, handling and installation

IS 15545 (Part 4) : 2004 Performance test procedures

IS 15545 (Part 5) : 2004 Identification of visual imperfections

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 1986 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publications), BIS.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards : Monthly Additions'.

This Indian Standard has been developed from Doc : No. **MGP 14 (392)**.

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110 002
Telephones : 2323 0131, 2323 3375, 2323 9402 *Website* : www.bis.org.in

Regional Offices :		*Telephones*
Central	Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110 002	2323 7617 2323 3841
Eastern	1/14 C. I. T. Scheme VII M, V. I. P. Road, Kankurgachi KOLKATA 700 054	2337 8499, 2337 8561 2337 8626, 2337 9120
Northern	SCO 335-336, Sector 34-A, CHANDIGARH 160 022	260 3843 260 9285
Southern	C. I. T. Campus, IV Cross Road, CHENNAI 600 113	2254 1216, 2254 1442 2254 2519, 2254 2315
Western	Manakalaya, E9 MIDC, Marol, Andheri (East) MUMBAI 400 093	2832 9295, 2832 7858 2832 7891, 2832 7892

Branches: AHMEDABAD. BANGALORE. BHOPAL. BHUBANESHWAR. COIMBATORE. FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR. KANPUR. LUCKNOW. NAGPUR. NALAGARH. PATNA. PUNE. RAJKOT. THIRUVANANTHAPURAM. VISAKHAPATNAM.

Printed at New India Printing Press, Khurja, India